SEMIPALATINSK REVISITED

RADIOLOGICAL EVALUATION OF THE FORMER NUCLEAR TEST SITE

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Various locations around the world are affected by residual radioactive material. Some of them are the result of past peaceful activities, while others result from military programmes, including the testing of nuclear weapons.

In the 1990s, there has been growing international cooperation in assessing the radiological effects of past military nuclear activities. In many countries, attention has turned to assessing and, where necessary, remediating areas affected by residual radioactive materials from military activities. The IAEA has been leading this effort of assessing former nuclear-weapon test sites. This article reports on preliminary radiological evaluations of the Semipalatinsk site in Kazakhstan, where the former Soviet Union conducted more than 400 nuclear tests over a forty year period.

Photo: Lake Tel'kem-2 in Kazakhstan, which resulted from a crater caused by a nuclear test. The test used three nuclear devices, each the equivalent of 240 tonnes TNT. (Credit: IAEA mission/July 1994)

THE SITE

The Republic of Kazakhstan is located immediately south of Russia, and west of China. Following World War II, the steppes of Kazakhstan became the first centre for nuclear weapons testing within the Soviet Union. The Semipalatinsk test site is a 19,000 km^2 zone in the north-east of the country, 800 km north of the capital Almaty. The zone lies southwest of the Irtysh River which flows into Kazakhstan from China and which, for a short distance, forms part of the nuclear test site boundary.

During the period 1949-89 the former Soviet Union conducted about 460 nuclear weapons tests within the test site. They included explosions that were conducted on the surface or in the atmosphere. Five of these surface tests were not successful and resulted in the dispersion of plutonium in the environment. Starting in 1961, more than 300 test explosions were conducted underground. Thirteen of the underground tests resulted in release of radioactive gases to the atmosphere. *(See table, page 14.)*

The only on-site inhabitants during the testing programme were in the town of Kurchatov whose purpose was to service the site, and in the small settlements of Akzhar and Moldari along the northern edge of the site. Recently there has been a limited amount of resettlement within the area, mostly by semi-nomadic farmers and herders. The bulk of the local population is in settlements just outside the site border. The total population of

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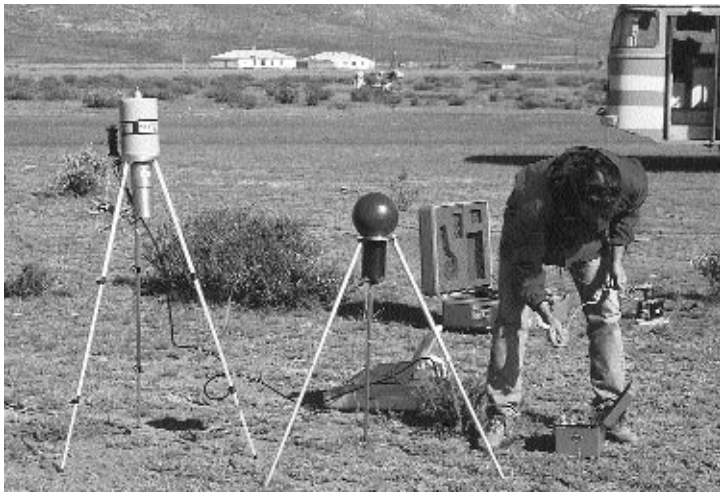
these settlements is estimated to be 30,000 to 40,000 people.

IAEA MISSIONS

In May 1993, representatives of the Kazakhstan Government informed the IAEA of their concern about the radiological situation in Semipalatinsk and western areas. Subsequently, the Government of Kazakhstan requested the IAEA to provide assistance regarding the former test areas of Semipalatinsk and western Kazakhstan. The IAEA agreed to organize a study of the radiological situation in these areas. This commitment resulted in a series of activities to characterize and evaluate the radiological situation at the Semipalatinsk test site.

November 1993. The first IAEA mission was performed in November 1993. The objectives were to become familiar with the test site and provide guidance on future actions. The team was also asked to assist in strengthening the national infrastructure in the area of radiation protection, with emphasis on environmental monitoring.

The team traveled to the Semipalatinsk site and identified the most likely areas of radioactive contamination on the test site as well as off-site. It also performed limited radiation measurements and collected environmental samples at identified locations to assist in further defining the concerns and provide information as to future actions. The team also visited governmental laboratories to determine their capabilities for cooperative efforts and to locate existing radiological assessment data.



Based on the results of this first mission, IAEA officers met in March 1994 at Agency headquarters in Vienna with a delegation from Kazakhstan. At this meeting, one topic of discussion was the concern about Semipalatinsk. In response to this concern, the IAEA agreed to establish, through its technical co-operation programme, a project to assist the Republic of Kazakhstan in the radiological assessment of the Semipalatinsk test site.

July 1994. A second IAEA mission to the test site was conducted in July 1994. The objectives were to collect additional radiological data from in and around the site, collect and review existing data provided by Russian and Kazakh sources relevant to the radiological situation at the test site, and to perform a prreliminary assessment of the present and potential future doses to residents in the Semipalatinsk area.

The goal was to determine whether further radiological evaluation and assessment were warranted. Soil, vegetable and milk samples were collected and analyzed by gamma spectroscopy and radiochemical analysis to determine radionuclide concentrations. Experts from the team spent time talking to inhabitants in the surrounding farms and settlements for the purpose of gaining information on the local diet and customs relevant to the dose assessment.

June 1998. A third mission was conducted in 1998 in compliance with a United Nations General Assembly Resolution (52/169M). In this mission an expert team intensively examined the consequences and needs arising from two generations of nuclear testing in the territory of what has been the Republic of Kazakhstan since 1991. The mission was composed of specialists from organizations and agencies of the United Nations including the IAEA, the Government of Kazakhstan, and other technical experts from the international community. The mission was deployed from 15

Photo: Specialists conduct in-situ gamma spectrometric measurements at Semipalatinsk during the IAEA mission in July 1994. *(Credit: IAEA mission/July 1994)*

to 30 June 1998 to carry out the needs assessment of the humanitarian situation in the Semipalatinsk Test Site Territory of Kazakhstan, as stipulated in the UN resolution.

FINDINGS OF THE MISSIONS

Based on information collected during the missions and subsequent research, there is sufficient evidence to indicate that most of the area has little or no residual radioactivity directly attributed to nuclear tests in Kazakhstan. There are a few areas that have elevated residual radioactivity levels within the test site where the surface tests were performed and where a few underground tests vented to the atmosphere. Preliminary surveys of these areas indicated that the contamination is relatively localized.

Due to the limited amount of survey data that was collected during the missions, the existence of actinide residues from the failed nuclear tests could not be corroborated. Descriptions of the nature of the failed tests, the prevailing conditions and any supporting data would be needed before further investigations are considered.

Currently there are no restrictions of access to the nuclear test site and limited reoccupation has already begun. An assessment of the exposure of persons who, on a daily base, visit the areas where the surface tests and vented underground explosions has been undertaken.

Initial findings of this assessment indicate annual exposures in the region of 10 mSv, predominantly due to external exposure. If these areas were permanently settled in the future, estimated exposures could be up to 140 mSv per year. This annual exposure is above the action level at which intervention is expected to be undertaken. Remedial action is, therefore, considered necessary for these localized elevated areas. However, due to budgetary and other constraints, the most appropriate remedial action at this time may be to restrict access to these areas.

The measurements made by the IAEA experts corroborate, to a reasonable degree, the more extensive surveys carried out by different organizations from Kazakhstan and the former Soviet Union. The combined results are considered sufficient to form the basis of a preliminary assessment of the radiological situation of the area around the Semipalatinsk test site.

The one exception to the above conclusion is the drinking water supply. While samples of drinking water taken during the missions showed no elevated levels of artificial radionuclides, sampling was not comprehensive. As such it is difficult to draw general conclusions about the entire water supply. In addition the results do not provide any guarantee about the future security of the water supply.

External dose rates. The external radiation dose rates and soil activity outside the test site are the same, or close to, typical levels in other regions and countries where no nuclear-weapons testing had been carried out. Some areas show small increases but these are not significant in terms of the exposure to the local population.

One village had a higher plutonium deposition level than the other settlements and has been the subject of more comprehensive soil sampling. However, estimated annual doses still remain low. Intervention to reduce the radiation exposure of people outside the Semipalatinsk test site is not considered to be justified. ❐

NUCLEAR TESTING AT SEMIPALATINSK

Duration of testing	Test Zone Geology	Number of tests
1949-62	Sandstone	Surface: 26 Air: 87
1961-89	Granite, quartz-porphyry, syenite rock mountain massif	In mine galleries: 215
1965-80	Alevrolite, porphyry, sandstones	In boreholes: 24
1968	Argyllite	In boreholes: 2
1965-89	Alevrolite, sandstones, conglomerate	In boreholes: 107